

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : COMMUNICATION & TRACKING FMEA NO 05-2R -5400 -1 REV: 06/27/88

ASSEMBLY : FWD BAY 3B  
 P/N RI : MC409-0025-400X  
 P/N VENDOR:  
 QUANTITY : 1  
 : ONE

VEHICLE 102  
 EFFECTIVITY: X  
 PHASE(S): PL LO

CRIT. FUNC: 2  
 CRIT. HDW: 2  
 103 104  
 X X X  
 OO X DO LS

PREPARED BY:  
 DES H D HADDAD  
 REL *7-5-87* J Y HARADA  
 QE J T COURSEN

REDUNDANCY SCREEN: A- B- C-  
 APPROVED BY:  
 DES *H D Haddad 5/27/88*  
 REL *J Y Harada 8-20-88*  
 QE *J T Coursen 8-22-88*

APPROVED BY (NASA):  
 SSM *John A. Hoff 9/9/88*  
 REL *John A. Hoff 9/9/88*  
 QE *John A. Hoff 9/9/88*

ITEM:  
 SPA, KU-BAND, SIGNAL PROCESSOR ASSEMBLY

FUNCTION:  
 PROVIDES BIT AND FRAME SYNCHRONIZATION, DEMULTIPLEXING, SIGNAL FORMATTING, DISTRIBUTION CIRCUITRY, DISTRIBUTION AMPLIFIERS, A CLOCK REGENERATOR, CONVOLUTIONAL ENCODING, COMMUNICATIONS MANAGEMENT LOGIC, AND FREQUENCY AND QPSK MODULATION FOR COMM OPERATIONS. PROVIDES DATA TO/FROM THE NSP'S FOR STATE VECTOR UPDATE. NOT A FUNCTIONAL LRU DURING RADAR OPERATIONS. 85V74A18

FAILURE MODE:  
 LOSS OF OUTPUT, ERRATIC OPERATION, INADVERTENT OPERATION, ERRONEOUS OUTPUT

CAUSE(S):  
 VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING, PIECE-PART STRUCTURAL FAILURE.

EFFECT(S) ON:  
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

EFFECTS ON ABILITY TO CONTROL, POSITION, OR LOCK ANTENNA GIMBALS - 3/3

(A, B, C, D) NO EFFECT ON LOCKING KU-BAND ANTENNA GIMBALS.

EFFECTS ON MISSIONS REQUIRING KU-BAND SYSTEM SUPPORT - 2/2

(A, B) LOSS OF KU-BAND COMMUNICATION.

(C) LOSS OF COMM MISSIONS REQUIRING KU-BAND DATA PROCESSING.

(D) NO EFFECT.

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EFFECTS ON PROVIDING DATA TO NSP FOR STATE VECTOR UPDATE - 1R/3

(A,B,C,D) LOSS OF ONE OF THREE REDUNDANT PATHS TO SUPPLY DATA TO NSP FOR STATE VECTOR UPDATE. UHF PROVIDES AN INDEPENDENT PATH FOR STATE VECTOR UPDATE. AFTER FOUR FAILURES POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF STATE VECTOR UPDATE. NOTE- A SINGLE FAILURE OF A KU-BAND SPA DASH NUMBER -4001 CAN CAUSE THE LOSS OF POWER TO BOTH NSP'S, RESULTING IN ONLY ONE REMAINING PATH (UHF) TO UPDATE THE STATE VECTOR. THIS FAILURE CAN OCCUR DURING ANY MISSION PHASE. (KU-BAND POWERED ON OR OFF.)

DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN

ALL EEE PARTS ARE SELECTED FROM OR IN ACCORDANCE WITH MF0004-400 (OPPL) REQUIREMENTS. SUBASSEMBLIES ARE QUALIFIED BY TEST OR USE OF EXISTING DESIGNS QUALIFIED FOR OTHER NASA & MILITARY PROGRAMS. THE HOUSING IS SEALED AND PRESSURIZED WITH NITROGEN/HELIUM GAS TO PROTECT CIRCUITS AND COMPONENTS FROM DIRECT EXPOSURE TO THE ENVIRONMENT. THE SYSTEM DESIGN INCLUDES A DEPLOYED ASSEMBLY JETTISON CAPABILITY WHICH CAN BE USED IF THE SYSTEM FAILS TO RESPOND TO LOCK OR STOW COMMANDS.

CONFIGURATION - ALL LRU'S ARE OF THE LATEST DASH NUMBER CONFIGURATION WITH THE FOLLOWING EXCEPTIONS - S/N 102, S/N 104 AND S/N 105 ARE OF THE -4001 CONFIGURATION. THIS CONFIGURATION DOES NOT HAVE COMPLETE CONFORMAL COATING (AIRBORNE CONNECTORS, FM MODULE, QPSK MODULE, AND WIREWRAP PLATE) AND LACKS POSITIVE RETENTION FOR BRASS PURGE VALVE CAP AND AIRBORNE CONNECTORS' JACKSCREWS.

(B) TEST

ACCEPTANCE TESTING OF ALL UNITS INCLUDES EXAMINATION OF PRODUCT, AVT, ATT, LEAK AND FUNCTIONAL TEST. QUAL TEST INCLUDES POWER, EMC, CABIN ATMOSPHERE, LEAK, BONDING, LOW PRESSURE THERMAL, THERMAL CYCLE, QAVT, QVT, LIFE, SHOCK, OVERPRESSURE AND PERFORMANCE AT THE LRU LEVEL. AS A PART OF QUAL TESTING, A SYSTEM TEST WAS PERFORMED WITH THE DA EXPOSED TO A QUAL LEVEL THERMAL VACUUM ENVIRONMENT AND THE EA-1, EA-2, AND SPA COLD PLATE TEMPERATURES CYCLED AT QUAL LEVELS. INTEGRATED AND SUBSYSTEM VERIFICATION IS PERFORMED AT KSC. SYSTEM DESIGN VERIFICATION TESTS WERE PERFORMED BY THE HUGHES AIRCRAFT COMPANY AT THEIR FACILITY. NASA CONDUCTED INTEGRATED KU-BAND AND TDSS VERIFICATION TESTS AT THE ESTL (JSC) AND SOFTWARE COMPATIBILITY TEST AT SAIL AND PASSIVE RADAR PERFORMANCE EVALUATION TEST AT WSMR.

GROUND TURNAROUND TEST - VERIFY FORWARD LINK OPERATION BY RECEIVING GROUND COMMAND TO CHANGE STEERING MODE. VERIFY RETURN LINK (FM/PM) OPERATION BY FRAME SYNC INDICATION OF 192 KBPS AT C & T STATION- PERFORMED EVERY FLIGHT.

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(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTION VERIFIES INCOMING MATERIALS.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PROCESSES ARE MONITORED BY QE. PRECAUTIONS ARE TAKEN TO PREVENT CONTAMINATION (SMOCKS, GLOVES, HATS, BOOTIES AS REQUIRED ARE WORN, AND EATING & DRINKING ARE PROHIBITED). SIGNS ARE POSTED IDENTIFYING CLEANLINESS REQUIREMENTS IN WORK AREAS.

ASSEMBLY/INSTALLATION

INSPECTION WITNESSES CONTAMINATION CONTROL, SOLDERING, BONDING AND TORQUE OPERATIONS. QE ENSURES WORK TICKETS REFLECT DRAWING AND SPEC REQUIREMENTS. DETAILED INSPECTION IS PERFORMED ON ALL ASSEMBLY AND DETAIL PARTS PRIOR TO NEXT OPERATION PER PROGRAM QUALITY REQUIREMENT AND WORK TRANSFER QUALITY REQUIREMENTS. INSPECTION REQUIREMENTS ARE TRANSMITTED TO OUTSIDE VENDORS, AND COMPLIANCE IS VERIFIED BY SOURCE INSPECTION AND VENDOR SURVEILLANCE. A FORMAL CONNECTOR ASSEMBLY/HANDLING TRAINING COURSE FOR ALL TECHNICIANS AND INSPECTORS WAS IMPLEMENTED IN NOVEMBER, 1986. NEW WORK STATIONS WERE INSTALLED IN THE EA-1/SPA ASSEMBLY AREA IN 1987 WHICH PROVIDE IMPROVED LAYOUT, REDUCED DAMAGE SUSCEPTIBILITY, AND IMPROVED LIGHTING.

CRITICAL PROCESSES

CRITICAL PROCESSES, SUCH AS, SOLDERING AND CRIMPING, ARE CERTIFIED. THE FORMAL CERTIFICATION OF ALL TECHNICIANS AND INSPECTORS FOR CRIMPING OPERATIONS WAS IMPLEMENTED IN NOVEMBER, 1986. ANNUAL VISION TESTS ARE GIVEN TO INSPECTORS. ALL CRITICAL PROCESSES ARE MONITORED AND VERIFIED BY QC PER PROGRAM QUALITY REQUIREMENT INSTRUCTIONS.

TESTING

INSPECTION VERIFIES ATT/AVT, LEAK AND INSULATION RESISTANCE/DIELECTRIC STRENGTH TESTS. USE OF NON-SKID TEST PROBES TO MINIMIZE SLIPPAGE WAS IMPLEMENTED IN SEPTEMBER, 1986.

HANDLING/PACKAGING

ALL KITTING, ASSEMBLY, TEST, INSPECTION, TROUBLESHOOTING, AND REWORK OPERATIONS ON STATIC-SENSITIVE DEVICES ARE PERFORMED AT STATIC-SAFE WORK STATIONS AND IN ACCORDANCE WITH PROGRAM INSTRUCTION. HARDWARE ITEMS ARE PACKAGED, PROTECTED, AND INSPECTED PER ENGINEERING DRAWING REQUIREMENTS AND PROGRAM QUALITY REQUIREMENT INSTRUCTIONS.

(D) FAILURE HISTORY

POST-ATP FAILURE HISTORY - CAR AC5471-010, S/N 103, FAILED TO SELECT COMM "B" DUE TO DESIGN ERROR - CORRECTED IN ALL UNITS.

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(E) OPERATIONAL USE

WORKAROUND TO REGAIN ABILITY TO CONTROL, POSITION, OR LOCK ANTENNA  
GIMBALS  
NO EFFECT, NONE REQUIRED.

WORKAROUND TO REGAIN SUPPORT OF MISSION OBJECTIVES  
COMM: NONE. RADAR: NO EFFECT, NONE REQUIRED.

WORKAROUND TO PROVIDE THE STATE VECTOR UPDATE  
THE STATE VECTOR CAN BE UPDATED VIA THE NORMAL S-BAND COMMUNICATIONS LINK  
OR VIA UHF/AUDIO.

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